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ABSTRACT

Until recently, professionals in the humanities have had access only to mainframe computer technology. The advent of microcomputers offers a range of new options. The experiences of one individual indicate that with personal computer technology and simple programming, and occasionally the help of a mainframe, textual, visual, and auditory information can be manipulated successfully. With regard to the first challenge, management of data input, several possibilities exist. Reproduction of a non-Roman orthography is possible by creating a system of transliteration into programming code; a number of texts are already available on CD ROM. Scanning and graphics adaptation technology assist in visual reproduction. Auditory materials are less easy to manage, and technology is currently under development. Data handling within the computer, the second major challenge, can be accomplished by a variety of cataloguing and classification schemes. For output, the third challenge, a dot-matrix printer or other bit-mapping device can be used to create an appropriate character set, and the printed results can be photographically enhanced. Computer-generated figures illustrate the possibilities. A brief bibliography is included. (MSE)

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The Use of the Personal Computer in the Humanities

James W. Marchand

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IDEAL 2, 1987

THE USE OF THE PERSONAL COMPUTER IN THE HUMANITIES

James W. Marchand

Humanists have in the past been tied to the mainframe and the tyranny of the keepers of the mainframe. The personal computer revolution has changed all this. The individual humanist now has available to him computing power far beyond that of the mainframes of the sixties. We cannot afford to let this opportunity pass. This article offers in its first part a survey of some of the applications of computers to the study of the humanities, including both tools and techniques. The second section of the article is a report on what one humanist has done with limited resources.

The most important thing that the new revolution in personal computers has done, and it is a revolution, has been to free the humanist from the mainframe, the keepers of the mainframe, and the tyranny of the programmer, with its eternal question of "What to Tell the Programmer" (Heal, 1971). The humanist, with his inborn tendency to go one-on-one with the texts he deals with, is, in George C. Homans' words, the last academic individualist (Homans, 1972). With the advent of the fifth generation and VLSI (very large scale integration), we may have reached the limits of miniaturization in the ergonomic sense. The keyboard can be redesigned, Dvoraked, or reconfigured, as is the new AT keyboard, but it cannot be made smaller; the miniaturization of the chip and the other components, however, continues at a merry pace. We can at the present time, for not a huge outlay of money, have a desktop with 170 megabytes of storage and 5 megabytes of addressable RAM. DOS 5 promises to give us soft and firmware to run these monsters. For more money, we can go as high as a 1.4 gigabyte hard disk, that is, a disk which will hold 1.4 billion characters. Each mail delivery brings news of dramatic new improvements, a megabit chip, an add-on to allow the AT to run at 4 to 5 MIPS (millions of instructions per second), ever new scanners and printers.

Even at present, I have on my "little" 1984 issue AT the entire Greek New Testament, the King James Bible, and the Gothic Bible, with plenty of room left over for the software to interrogate them. I was able to buy an Oberon International Omni-Reader for $70 which allows me to input without keying in, so long as I stay within the narrow limits of office typewriting. Even on my Seiko UC-2000 watch, I can put enough answers to allow me to cheat through any hour exam, a kind of electronic sleeve, as it were. For the purposes of this article, however, I have for the most part stuck with a minimum configuration. Most of the things I

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discuss were done on an IBM PC with 256K of RAM and an IBM Graphics printer. Almost all the programming was done in uncompiled BASIC or using batch files with DOS. On the present market, I could do most of it with an outlay of less than $700. The work was done mostly by one humanist, working alone, with no advice from a team of programmers. I say "mostly", since I occasionally uploaded to the mainframe in ASCII for this or that large task which I could have done on a 256K machine, but which would have consumed inordinate amounts of time. Being an individualistic humanist type does not mean that one has to be stupid.

This article is divided into three sections, input, handling, and output. Before I begin, let me make a bow towards the mainframe and describe one project which is being done by a team. Professor Spurgeon Baldwin, Robert Booth and I have a project using computer enhancement to read manuscripts which cannot be read by the naked eye. This consists of obtaining a picture of a manuscript, done by the best photographic techniques available, digitizing it with a digitizing camera and downloading it into the computer's memory. The software assigns to the picture 256 levels of gray, each of which is addressable. One can then ask the machine to do whatever one wants with each level of gray, give it any color, ignore it, etc. If, for example, the original manuscript is a palimpsest, in which one text is written over another, it is possible to separate the scripts. We are frequently able to read letters and words in Gothic manuscripts, for example, which have resisted all previous efforts.[1] This takes, of course, enormous computing power, though with a large memory, PC-EYE and IMiGIT,[2] one can do something like this on a desktop. The recent advent of FFT (fast Fourier transform) programs for the personal computer will lighten our burden tremendously.

INPUT

The first problem one encounters in dealing with textual, visual and auditory materials is the difficulty of getting them into the computer. With texts, one can simply type them in; if one is dealing with a language with a "strange" writing system, one can make up a system of transliterations into ASCII symbols, numbers, etc. Even using BASIC and the draw command, one can have them appear on the screen in the original form. Note the simple screen shown in Figure 1 (slightly retouched, for reproduction purposes), in which the runes (the Old Germanic writing system) welcome conference participants to Chambana, turn upside down, change colors, etc. (cf. Illowsky & Abrash, 1984:166f.). This demonstrates that it is possible, with little effort, to have the output device show the characters in their original form. I have devised cuneiform, hieroglyphic, runic, and Gothic characters. Texts can be input by the lazy or impatient using a scanner, such as the Kurzweil Data Entry Machine,[3] which has been programmed to

Figure 1. Availability and mobility of a non-Roman orthography on a computer monitor.

read almost any writing system, the PC Scan,[4] which is much faster and reads about 10 fonts, or the Datacopy,[5] which is also trainable and is faster than the Kurzweil, though not so fast as the PC Scan. For those with money, the miraculous self-training Palantir Compound Document Processor rivals the Kurzweil.[6] Even the lowly OmniReader can do some texts. Thus, we have already arrived at the time when a private scholar can expect to be able to buy an OCR (optical character recognition device) and input his own texts.

The private scholar who belongs to the right clubs can also be expected to be able to tap into the burgeoning CD ROM industry. Already available on one CD ROM disk is the Thesaurus Linguae Graecae, with most of the Greek texts from the beginning to 600 AD (Berkowitz & Squitier, 1986). The FCAT group at the University of Pennsylvania, also with Packard Foundation backing, as reported by Bob Kraft (Offline 6, 1986), will have a huge number of Biblical and Patristic texts available on CD ROM for members who share their texts. The Public Domain group has 605 diskettes available on one CD ROM, which Lambert & Ropiequet (1986) have aptly called the new papyrus (cf. also Ropiequet, 1986). For those who are able to afford it, the corpora of London, Louvain, etc., can also be downloaded or obtained by mail. There is a clearinghouse for such corpora at Rutgers. By modem, and one can now buy a half-card Hayes compatible 1200 baud modem for less than $100, one can contact any number of data-bases both here and abroad. There is a new gateway service offered by the venerable Western Union at the cost of $25 per year. In addition, many texts which were typeset by computer are

graphic work the humanities scholar must do, the R. R. Bowker Co. has all its catalogues available on one CD ROM disk. Most larger libraries have automated their catalogues; one can even call up and download the Library of Congress Subject Headings. Foreign libraries may also be accessed by modem. In short, we are able to input texts in many different ways, and with the continuing work on OCR, we may be able soon to begin reading manuscripts such as the Codex Argenteus, the major source of our knowledge of Gothic, with its regular handwriting, without benefit of the human finger.

Visual materials such as the Mona Lisa or Swedish church art can at present be input into the machine to be worked on, and scanners are getting better and better. With the advent of EGA (Extended Graphics Adapter) technology, one can have fine resolution 16 color palettes, making the Mona Lisa, the favorite of EGA hackers, look pretty good. Archives of art and such things as runestones should soon be available by remote transfer to any humanities scholar, so that the medievalist will not find it necessary to make his yearly trek to Princeton or the runologist his trip to Sweden. In fact, the libraries and art galleries of Europe ought to be available in machine-readable form. Our present technology permits three-dimensional recording for dealing with runestones and other monumental forms.

As far as auditory materials are concerned, we are still in the infancy of an important field. The MIDI (musical instrument digital interface) explosion, an explosion within an explosion, as it were, has made it possible to do many things with music. Inputting tunes into the computer is no problem for those who can read music only slightly. My computer even plays "She'll be Coming round the Mountain," "Mama's Not Dead, She's Only a-Sleeping," and any number of tunes on the funky piano, using Neil Rubenking's algorithms and devices.[7] Using MIDI techniques, however, with a multi-voiced output, one can input medieval music and play it with different time signatures, etc., whether or not one knows anything at all about music. I can assure you that this is a boon for those who teach medieval minnesong.

In contrast to music, the inputting of speech is much more complex and demanding. Since we do not have at present voice input machines which work sufficiently well, most speech data must be keyed in by hand, an arduous and time-consuming task. However, some progress has been made; IBM has announced a prototype which recognizes 20,000 words, somewhat larger than many people's active vocabulary, and which disambiguates words by searching both the immediate and the subject context.

HANDLING

What does one do once something is in the computer? First, one can catalog things easily, simply by assigning

them numbers, as is done by the Motif-Index of Folk Literature of Stith Thompson (1966). The following is an example from my own work: If one looks at the ceiling of a medieval Swedish church, one will notice that it is painted in beautiful colors. A closer look will show that it is divided into individual paintings, and that these are organized into schemes. A further examination will show that these pictures follow the organization of the ribs in the vaults. Medievalists have come to recognize most of the schemes, calling this the science of iconography, and the learned doctors of Leyden have arrived at a numerical scheme which registers these. For example, any medievalist seeing a man with the jawbone of an ass in his left hand would immediately recognize Cain, who, in the medieval view, slew Abel with the jawbone of an ass (Schapiro, 1979). What I have done in my ongoing study of medieval Swedish church art is to organize the ceiling of the church into areas according to the four schemes of ribbing, so that we can now say what occurs and where it is found in the more than 15,000 paintings which Albertus Pictor made in his lifetime. With EGA techniques, enhancement techniques and the possibility of putting text on our pictures, we can now make statements about Swedish medieval painting which were impossible before, even including athetizing one of his churches (Marchand, 1976).

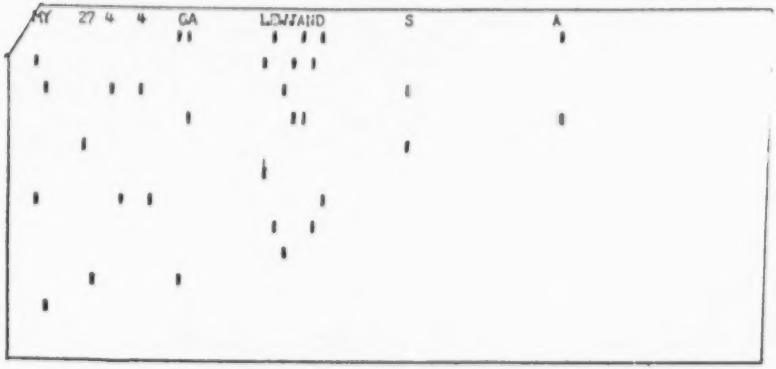
Figure 2. A page of the Codex Argenteus

Let us speak for a moment of the nature of the beast for the medieval philologist. Figure 2 (Uppsala University Library, 1955) is a representation of a page of the Codex Argenteus, one of the most precious manuscripts in the world, presently residing in Uppsala, Sweden, booty from the 17th century wars of Queen Christina. It is written in a unique alphabet, in gold and silver on purple parchment, probably for Theodoric the Great, since the canon tables at the bottom of the page seem to be modeled on his castle in Ravenna. I entered this text on punched cards in 1960, with a grammatical analysis of each word, in a scheme which looked somewhat like Figure 3. In 1960 we did not have mag tape, we programmed in FORTRAN or not at all, and we had no string manipulation capability. One had to input the grammatical codes or one did not have them. Figure 3, from a talk I gave at the Modern Language Association meeting in 1966, shows what we could obtain even then.

I. The fields on a Gothic card:

Book - chapter - verse - number of word in sentence - prefix - stem - ending - particle - grammar code - foreign word! - error?

II. Sample card.



III. Questions asked:

1. alphabetized list of tokens.
2. backwards alphabetization of tokens.
3. sentence print-out.
4. comparison of sentences for length.
5. grapheme count.
6. grapheme plus environment.
7. alphabetized concordance.
8. alphabetized grammar concordance (acc. to grammar code).
9. backwards alphabetization of this (gathering cases, etc.).
10. alphabetized list of stems.
11. Syntactical statement of grammar codes.
12. Numerical print-out.
13. Lists of word-types according to various criteria.
14. Gatherings of prefixes and of particles.

Figure 3. Coding a text on a punched card.

Today we can do all kinds of things with the text. We have a concordance, both backwards and forwards, to be discussed below. This means that I can sit at my computer and ask for all the endings of Gothic to be displayed, since the head-words have been alphabetized backwards. Since I have the context, in a grammatical buc (basic unit of concordance) chosen by a person who can read Gothic, namely me, I can reject or accept the samples and arrive at a fairly good grammar of Gothic, including the context of each item talked about, in a short length of time. This means that I have an on-line grammar of a language with a minimum of human interference and the assurance that I have been exhaustive. I am working on a soundex routine (the soundex algorithm is well-known, I do not have to invent it) which will allow a person who knows Gothic only vaguely (a student) to look up a word. Using the King James text and Trinity's Greek text I can parallel the Gothic with its original and a translation and modify those wherever I wish (Figure 4).

```
MY 6.24  Ni manna mag twaim fraujam skalkinon

MAT 6:24  NO   MAN  CAN  SERVE TWO  MASTERS:
          3762 3762 1410 1398  1417 2962

                          7DUNAMAI
MT 6:24 N6OUDEIS12MXNX N7DUNATAI 3SPPI N4DUSI 12MPDX

                          7DOULEUW
          N7KURIOIS    N9 DOULEUEIN9 PAN
```

Figure 4. Lines from a database containing parallel translations in Gothic, English and Greek.

Here the first line represents the Gothic text, the second the King James version in English, as furnished by The Greek Transliterator, by Bible Research Systems. The numbers underneath the line in this version refer to Strong's well-known Concordance. For example, if one places the cursor at 2962, one receives the following entry:

```
STRONG'S REFERENCE NUMBER: 2962
GREEK:          KURIOS
DERIVATION:
DEFINITION:     SUPREME IN AUTHORITY.
```

The final line is from the Greek New Testament, as furnished by Project GRAMCORD. It contains a complete parsing of the Greek, whence its mysterious look. It reads: OUDEIS DUNATAI DUSI KURIOIS DOULEUEIN. Since it represents a one-to-one transliteration, the original Greek is totally recoverable. One can even have a King James version of the New Testament in a memory resident form with the WordWorker from The Way, and a Greek form is promised. With these tools one can make a complete study of the relationship of the Gothic to its

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Greek original, including such things as Wulfila's rendering of Greek grammatical features.

With my poor memory, I need to be able to find texts I only vaguely remember, either by searching the English and the Greek, or by using a discontinuous finding routine, such as the batch file displayed here:

```
finder.bat
echo off
FIND/N %2  %1          >PARM1.DAT
FIND/N %3 PARM1.DAT    >PARM2.DAT
FIND/N %4 PARM2.DAT    >PARM3.DAT
```

I remembered the quotation "No man can serve two masters" in Gothic, for example, as ni twaim and skalkinon. Using the simple sieve technique shown here, taken from the DOS manual, I could find the unique sentence which contained those three words:

```
finder mtjn.doc "ni" "twaim" "skalkinon",
```

namely, Mt. 6.24. If there had been more than one such sentence, I could have found them. It is possible, of course, to output to the screen, the printer, a file, a serial port, or any other device one could or would connect up. A simple use for a search is the following: The word gaggida as the past tense of gaggan occurs only once in Gothic; a DOS search reveals instantly where, and sometimes a grammatical hit is possible, even where, as above, the words are not contiguous. Streitberg once wrote on the construction þaim izei 'to those who' that it was the most Gothic of constructions, unparalleled in the Greek. A simple search reveals that it occurs only once. You see that having ones texts "on line" in this way can reveal things impossible to determine otherwise. Our Ambrosian codices contain different versions of the same text. A use of the BASIC <inst> command allows us to compare the two texts and indicate where they differ, and we can output this to any device for more work and perusal. Just by inserting a count loop into our program, we can obtain any kind of statistics we want.

OUTPUT

Let us turn for a moment to the matter of output. I do not want to get into desk-top publishing, but those who tell you that you cannot obtain camera ready copy from a dot-matrix are deceiving you. Figure 5 shows a sample of camera-ready copy of my soon to be published Gothic concordance, which demonstrates the formatting capabilities of the PC. It was done using an IBM Graphics printer. Figure 6 shows a page of a grammatical (retrograde) concordance of Gothic as it came off the page printer. If you have world enough and time, you can develop a font and print it using a dot matrix,

A

a 5 0.00743
1CrA 99:1 du Kaurinþium .a. ustauh
1ThB 99:1 du Þaissalauneikaium .a. ustauh.
1TmA 0:1 du Teimauþaiau .a. dustodeiþ
Nh 5:18 jah was fraquman dagis hwizuh stiur .a. lamba gawalida .q.
Nh 5:18 jah gaits .a. gamanwida was mis.
aba 6 0.00892
RmA 7:2 aþþan jabai gaswiltiþ *aba*
1CrA 7:14 jah gaweihaids ist *aba* sa ungalaubjands in qenai.
1CrA 11:3 iþ haubiþ qinons *aba*.
1TmA 3:2 ainaizos qenais *aba*.
1TmB 3:2 ainaizos qenais *aba*.
TiB 1:6 ainaizos qenais *aba*:
aban 7 0.0104 aba
Lk 1:34 hwaiwa sijai þata þandei *aban* ni kann.
Mk 10:12 jah jabai qino afletiþ *aban* seinana. jah liugada anþaramma horinoþ:
1CrA 7:11 jah *aban* qen ni fraletan
1CrA 7:13 jah qens saei aigi *aban* ungalaubjandan
1CrA 7:13 ni afletai þana *aban*.
1CrA 7:16 hwa nukkannt þu qinon ei *aban* ganasjais.
GlB 4:27 unte managa barna þizos auþjons mais þau þizos aigandeins *aban*.
abans 1 0.00149 aba
1TmA 3:12 diakaunjus sijaina ainaizos qenais *abans*
abba 1 0.00149
GlA 4:6 hropjandan *abba* fadar.
Abeilenes 1 0.00149 Abileini
Lk 3:1 jah Lwsaniaus *Abeilenes* fidurraginja.
Abiaþara 1 0.00149 Abiaþar
Mk 2:26 hwaiwa galaiþ in gard gudis uf *Abiaþara* gudjin
Abijins 1 0.00149 Abia*
Lk 1:5 was in dagam Herodes þiudanis Iudaias. gudja namin Zakarias us afaram *Abijins*.
abin 8 0.0119 aba
Lk 1:27 du magaþai in fragibtim. *abin* þizei namo Iosef us garda Dawveidis
Lk 2:36 libandei miþ *abin* jera sibun fram magaþein seinai.
RmA 7:2 jah auk ufwaira qens at libandin *abin* gabundana ist witoda

Figure 5. Sample page from a Gothic concordance.

in fact, using any bit-mapped device you like, such as a screen. Our students unfortunately usually read Gothic in transliterated form, since it is so expensive to typeset it, given the fact that the fonts can only be used on those rare occasions when one prints Gothic (Fairbanks & Magoun, 1940). It is as if you taught Russian or Greek in Latin letters. Early scholars on Gothic tried to cut or cast their own fonts, with varying degrees of success. What Christopher J.

```
!D00003 BA              \    5   .00742821
LU 0106     WESUNUH YAN GARAIHTA (BA) IN ANDWAIRYJA GUDIS.
LU 0107     JAH (BA) FRAMALDRA DAGE SEINAIZE WESUN.
LU 0507     JAH GEHUN JAH GAFULLIDEDUN (BA) YO SKIPA SVE SUGGUN.
AM 0214     SAEI GATAWIDA YO (BA) DU SAMIN
AI 0214     SAEI GATAWIDA YO (BA) DU SAMIN.

!D00004 ABA             \    8   .00891385
RM 0702     AYYAN JABAI GASWILTIY (ABA)
CN 0714     JAH GAWEIHNIDS IST (ABA) SA UNGALAUBJANDS IN GENAI.
CN 1103     IY HAUBIY GIHONS (ABA).
TT 0302     AINAIZOS GENAIS (ABA).
TI 0302     AINAIZOS GENAIS (ABA).
TE 0106     AINAIZOS GENAIS (ABA)!

!D00005 GAREDABA        \    1   .00146564
RM 1313     SVE IN DAGA (GAREDABA) GAGGAIMA

!D00006 UNFAIRINGDABA   \    1   .00146564
TH 0210     JAH (UNFAIRINGDABA) IZWIS YAIM GALAUBJANDAM WESUM.

!D00007 FRGDABA         \    2   .00297129
LU 1608     JAH HAZIDA SA FRAUJA YANA FAURAGAGGJAN INWINDIYOS UNTE (FRGDABA) GATAWIDA.
MK 1234     JAH IESUS GASAIVANDS INA YATEI (FRGDABA) ANDHOF GAY DU IMMA

!D00008 HARDABA         \    1   .00146564
CO 1310     EI ANDWAIRYS (HARDABA) NI TAUJAU

!D00009 GAGUDABA        \    2   .00297129
YY 0312     JAH YAN ALLAI YATEI WILEINA (GAGUDABA) LIBAN IN XRISTAU IESU. WRAKOS WINNAND.
TY 0312     JAH YAN ALLAI YATEI WILEINA (GAGUDABA) LIBAN IN XRISTAU IESU WRAKOS WINNAND.

!D00010 GABIGABA        \    1   .00146564
KG 0318     WAURD XRISTAUS BAUAI IN IZWIS (GABIGABA).

!D00011 HABA            \   10   .01465641
JN 0649     IK UNHULYON NI (HABA)
JN 1018     WALDUFNI (HABA) AFLAGJAN YO.
JN 1018     JAH WALDUFNI (HABA) AFTRA NIMAN YO.
CN 0725     AYYAN BI MAUJOS ANABUSN FRAUJINS NI (HABA).
CN 1531     BROYRJUS YOEI (HABA) IN XRISTAU IESU FRAUJIN UNSARAMMA.
CO 0204     YOEI (HABA) UFARASSAU DU IZWIS.
CR 0204     YOEI (HABA) UFARASSAU DU IZWIS.
CR 1112     IY YATEI TAUJA JAH TAUJAN (HABA).
```

Figure 6. Section of a reverse (grammatical) concordance of Gothic.

Meyer and I decided to do was a radical departure from 20th century tradition, namely to teach students to read Gothic in the Gothic script. If we wanted to imitate early workers, we could do much better than they, but that would merely be a modernization and one font. We decided early on to put our Gothic out in the original script. What we did was simple. We photographed photographs of the manuscripts, made transparencies of them, enlarged them and projected them on the wall using an overhead projector, traced them, put them on the computer screen and bit-mapped them. We thus arrived at an character set we could use to "type" a manuscript. The process is shown in figure 7. By the same process, we generated fonts for each of the various hands used in our Gothic manuscripts (there are 22; some are shown in figure 8). The results are good enough to fool experts. They were done on a 256K IBM PC with an IBM Graphics dot matrix printer. One can even simulate Gothic print on a dot matrix printer, so that textbooks can again be put out in Gothic (Figure 9). A piece of the Codex Carolinus (Figure 10) and of Hand II of the Codex Argenteus (Figure 11, with appropriate typos) will show you the results obtainable.

We come to our <u>pièce de résistance</u>. Imitating hands did not suit us, for we wanted more. We wanted to reconstitute a manuscript, to make a replica of the Codex Argenteus which looked more like the codex than it itself did. That is, we

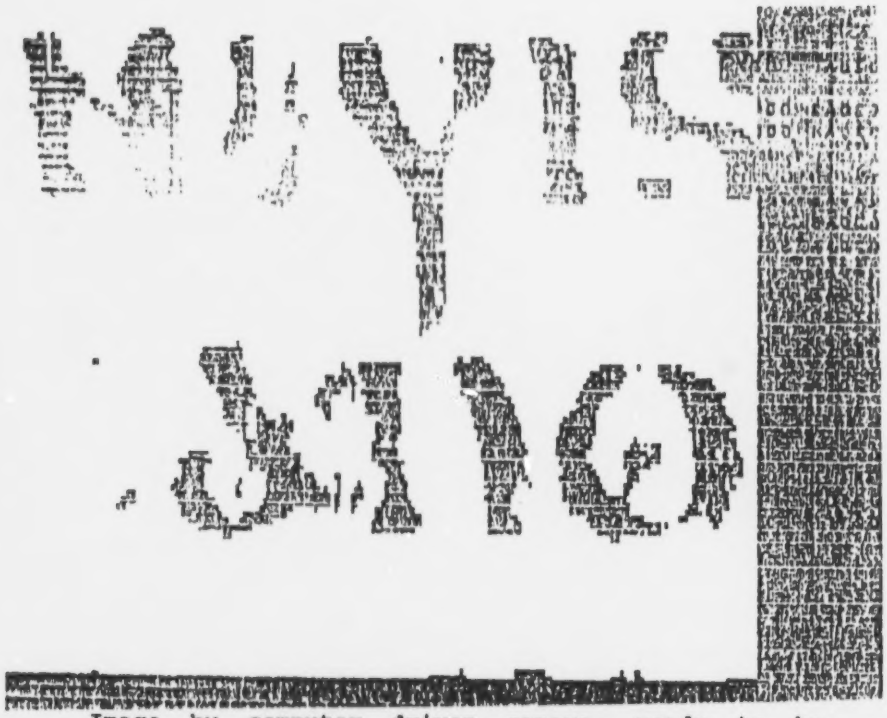
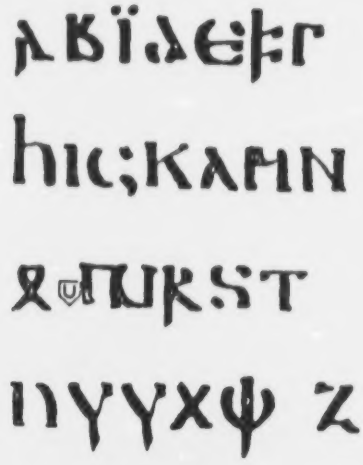


Image by computer driven camera, ready to be smoothed and contour filled, then reduced.



Font produced by electromagnetic process

Figure 7. Stages in developing a Gothic font for a bit-mapped printer.

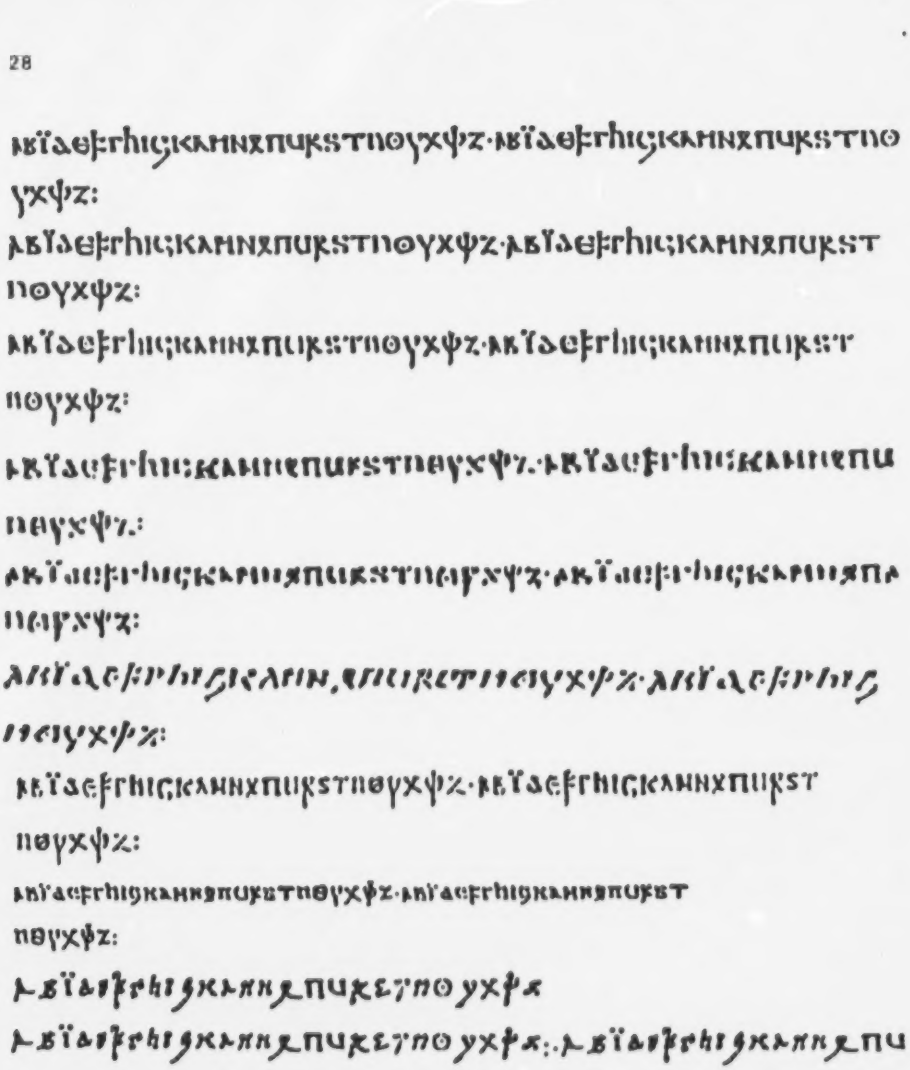


Figure 8. 10 Gothic fonts produced on a dot matrix printer.

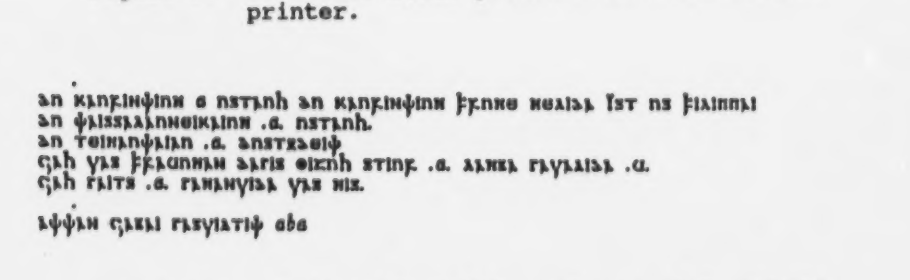


Figure 9. "Printed" Gothic using a dot matrix printer.

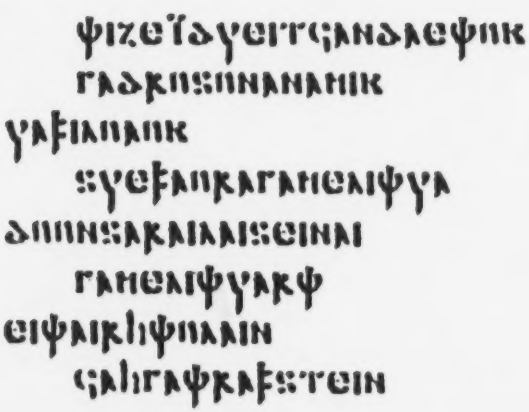


Figure 10. A dot-matrix facsimile of the Codex Carolinus.

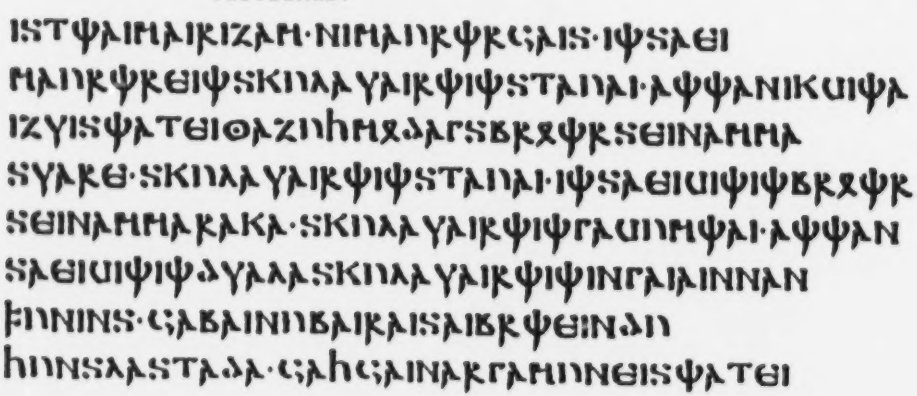


Figure 11. A dot-matrix facsimile of Hand II of the Codex Argenteus.

wanted a manuscript which looked like the original of ca. 520 A.D., one which people could read. What we did was to use a digitizing camera to download pictures of the characters. Using enhancement techniques familiar from our space effort, we contour-rounded and filled in these characters, ending up with a type font which allowed us to type the manuscript, with the appropriate, but unintentional typos (Figure 12). We had paper made which had the right shade of purple, ran our typed manuscript off on the Imagen, a prototype laser printer, made a transparency of this, had it silk-screened onto the paper. For technical reasons, I cannot print the actual result, in gold and silver on purple paper, but it looked some-what like Figure 12. The result could and has fooled experts, who thought we had simply made an excellent photograph of the manuscript, perhaps touched up. You will

say that this is a rather expensive project and requires teamwork and money. It could be done, however, with a dot matrix, a video camera and PC-EYE, and one could run it off on a cheap silk-screen device such as a Rex Rotary.

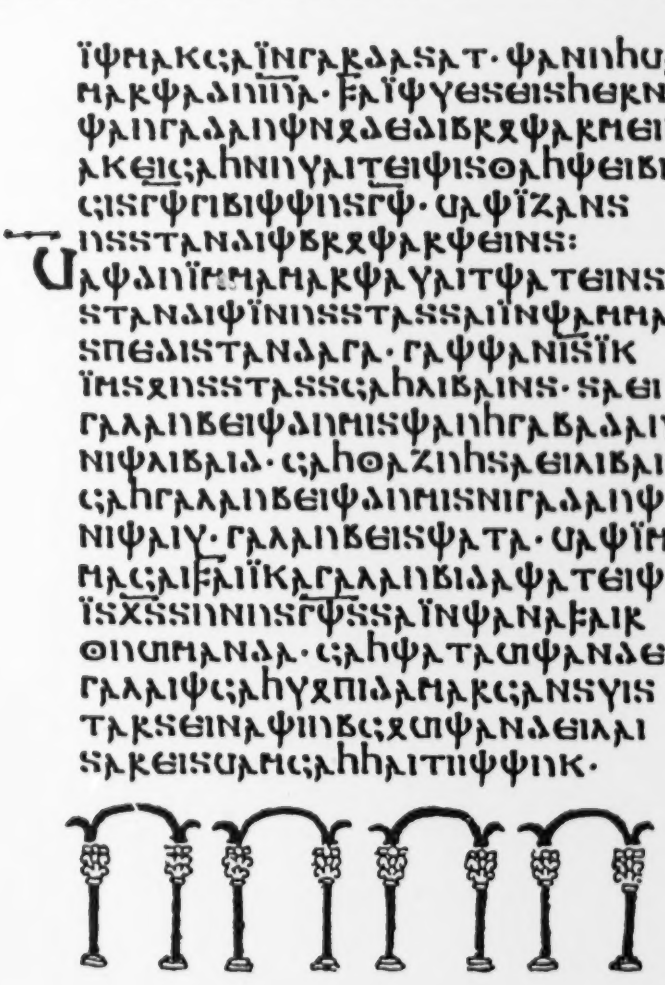


Figure 12. A computer-generated facsimile of the Codex Argenteus. Note the typo in the fourth character.

In conclusion, what I have tried to present here is not in and of itself worth very much. But it is the attempt of a humanities scholar, working very much by himself, with machines and tools he bought himself, in other words, the cottage industry we humanists are accustomed to. If

humanists are to use computers, this is pretty much the way they are going to have to go until funding and teams are available. Homo sapiens and homo silicensis really need to be brought together in the individual humanities scholar if real progress is to be made. Se non è ben trovato, è vero.

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NOTES

[1]The December, 1986 issue of Omni reports on a similar project to read the Syrus Sinaiticus, another Biblical palimpsest (Baker, 1986).

[2]PC-EYE and IMiGIT are trademarks of Chorus Data Systems.

[3]Kurzweil Data Entry Machine is a trademark of Kurzweil Computer Products.

[4]PC Scan is a trademark of Dest Corporation.

[5]Datacopy is a trademark of Datacopy Corporation.

[6]Compound Document Processor is a trademark of Palantir Corporation.

[7]Neil J. Rubenking is the acknowledged king of shareware music. He has produced a number of Shareware programs, including Pianoman.

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